Asia Science Letter

Information Bulletin of the Asian Office of Aerospace Research and Development Tokyo, Japan

ASL Volume 22 **Nov-Dec 99**

The Asia Science Letter is a bi-monthly publication of the Asian Office of Aerospace Research and Development (AOARD), Detachment 2 of the US Air Force Office of Scientific Research (AFOSR), the basic research manager of the Air Force Research Laboratory (AFRL). Its purpose is to inform the Air Force S&T community on the research and development activities in Asia and Pacific Rim countries including India and Australia. The assessments in this periodical are solely those of the authors and do not necessarily reflect official US Government, US Air Force, or AFOSR positions.

Highlights

I am delighted to announce the arrival of Dr. Brett Pokines on 1 Sep 99. Brett joined AOARD under the Intergovernmental Personnel Transfer Act (IPA) from the Rochester Institute of Technology, Rochester, NY where he is an Assistant Professor of Mechanical Engineering. Brett's technical specialties are in Microsystems fabrication methods, materials, components, and systems. He has been a Japan Society for Promotion of Science Fellow at Tohoku University, Sendai, Japan, and a Science and Technology Agency Fellow at National Aerospace Laboratory in Tokyo, Japan. Brett's major duties at AOARD are to identify innovative or radical methods in Asia of applying Microsystems techniques; examine applications in space, air vehicles, information, sensors, propulsion/power, munitions, directed energy, and human factors; and to liaison with the Air Force technical community. I am confident that Brett will assist the Air Force in keeping pace with the current trend and increasing needs to miniaturize various systems.

I am also pleased to report that SSgt Michael Adams of AOARD received an award from the Yokota AB -- a membership to the "Ninety Percent Club" -- for scoring an outstanding 93% on his 7 level Career Development Course examination (in Computer Systems). Mike is the reason why AOARD's computer network functions well and you are getting our electronic newsletters. Great job, Mike!

Dr. Koto White
Director, AOARD

News Briefs

News: Sumitomo Metal Industries, Ltd. Amagasaki, Japan, Produces "Fishbone" Sensor:

An acoustic sensor called the "Fishbone sensor" is a device that has been demonstrated as a prototype sensor by the Device Technology Section of the Electronics Components and Research Department and is now being marketed. The sensor's design is based on the human auditory system and mimics the vibration response action of the cochlea. The design produces a sensor that measures vibration magnitude at specific frequencies. The researchers have created a completely mechanical real-time power spectrum measurement device. Prototype sensors measuring frequencies between 500-4000 Hz have been fabricated and tested. The sensor testing data indicates a linear magnitude response. Commercial fishbone sensor applications include use of the device in systems such as health monitoring, active control, speech recognition and telecommunication.

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Sumitomo Metals diversified starting in 1983 into the electronics material and parts business. The electronics business group now primarily produces products in the area of LSI packaging. Sumitomo Metal Industries five years ago started to focus on the microsystems or micro-electro-mechanical systems (MEMS) field. The result of this research effort is the completion of several prototype devices (e.g. acoustic sensors, electro-static actuators, micro-coil based magnetic sensors) that are currently being marketed. Sumitomo Metals also recently began to offer prototype and systems development service in the field of MEMS. Fabrication processes available include dry etching (Si, SiN, SiO_2, Al), deposition (CVD, PVD), ion implantation (B, P, As), deep Si RIE and electroplating. (Pokines)

Space & Communications

Feature Article: Simulation of Flight of International Crew on Space Station (SFINCSS-99), Joint Japanese, Russian, European, and Canadian Study. Interview with Dr. Norbert Kraft, National Space Development Agency of Japan (NASDA):

On March 30, 1999 the National Space Development Agency of Japan (NASDA) signed an agreement with the State Research Center of the Russian Federation "Institute for Biomedical Problems" to collaborate on a 240 day simulation of flight activities for international crews aboard the International Space Station (ISS). The European Space Agency, the Canadian Space Agency, and two U.S. Universities (Baylor and University of Wisconsin) will also participate. This unique study will be the first long-term isolation study involving crews of different nationalities.

Organized by Russia, the study will be conducted at the Institute for Biomedical Problems (IBMP) in Moscow in two connected International Space Station mock-ups, 2,950 cubic feet and 5,800 cubic feet respectively. Russia has developed both extensive operational experience and expertise in isolation research over the past 35 years. Japan will provide both funding for the research and three principal investigators, including Dr. Koh Mizuno, Mr. Natsuhiko Inoue and Dr. Norbert Kraft, an Austrian Flight Surgeon, currently working as a researcher at NASDA in Tsukuba, Japan.

With the exception of microgravity, all the major stressors anticipated in future ISS missions will be simulated including confinement; environmental parameters (e.g., gas composition, pressure, humidity, temperature, noise), work schedule, limited communication with the outside world, and hygiene facilities will be simulated. Investigators will also simulate difficult in-flight situations including unusual stresses such as sleep deprivation in order to make conditions in SFINCSS-99 as similar as possible to the actual International Space Station. The official language of the study will be English.

SFINCSS will be a large study with many experimental protocols included in the following areas of study:
- Group Psychology (11 protocols)
- Individual Psychology and Performance (11 protocols)
- Physiology and Health (22 protocols)
- Biochemical and Immunological (8 protocols)
- Sanitation, hygiene, and microbiology (4 protocols)
- Operations and technologies (3 protocols)

A unique feature will be the opportunity to study crews of different nationalities working and living together. One concern is that national, cultural, religious, professional and other differences could be the basis for the formation of subgroups on the ISS. This study should help medical personnel to optimize space-flight medical support and more accurately predict the deterioration of crew performance. Crews will include:
- Group 1 (240 days): 3 Russians and 1 Tarter subject
- Group 2 (110 days): 3 Russians and 1 German subject (University of Berlin)
- Group 3 (110 days): 1 Russian, 1 Canadian, 1 Japanese, and 1 European subject

This project is a high-fidelity simulation of ISS flight and, accordingly, is not just another isolation study. It is expected to generate data of immediate application to the ISS environment. (Lyons)

Site Visit: Korea Advanced Institute of Science and Technology (KAIST), Satellite Technology Research Center (SaTReC), Taejon, Korea; 9 Sep 99:

The SaTReC is a KAIST university based research center for satellite technology and applications research. This center was established in 1989 and has its own satellite integration facility, testing facility, and remote sensing (downlink) facility. In 1992, the first scientific micro-satellite (48.6 kg) called Korea Institute of Technology Satellite-1 (KITSAT-1) was co-developed with the University of Surrey (UK) and was launched (piggy-back)

on a French Ariane4 launch vehicle. The experimental payload included a Charge Couple Device (CCD) Earth Imaging System and Cosmic Ray Experiment. The main objective of this project was to develop satellite technology and train satellite engineers. The following year, KITSAT-2 was launched on an Ariane4 launch vehicle. This satellite was identical to KITSAT-1, however many components were domestically manufactured including the equipment to carry out experiments such as Low Energy Electron Experiment and Infrared Sensor Experiment. In May 1999, using the Indian Polar Satellite Launch Vehicle (PSLV), a three-axis stabilized remote sensing KITSAT-3 was successfully launched. The operational KITSAT-3 took images of the Korean peninsula using a linear pushbroom CCD camera (3456 pixels). Other scientific experiments were conducted using a high-energy particle telescope, an electron temperature probe and a magnetometer. Although, KITSAT-3 was an indigenous satellite system, its design was based on knowledge and experience acquired from the previous KITSAT programs. The KITSAT-3 satellite bus can accommodate different payloads for various missions using a common standard interface. Currently, SaTreC is developing a fourth micro-satellite (KAISTSAT-4) to test and demonstrate it's three-axis attitude control and the satellite bus structure. This satellite will have on-board payloads to perform space science experiments using such instruments as UV Imaging Spectrograph, Solid State Telescope, and Narrow Angle Star Sensor. This project is schedule to be completed by August 2002. (Kim)

Site Visit: RIEC and MEMS Technology Forming Imaging Systems of the Future, Research Institute of Electrical Communication, Tohoku University, Sendai, Japan; 21 Sep 99:

The Terahertz Engineering Laboratory in the Research Institute of Electrical Communication (RIEC) at Tohoku University is developing methods to utilize and control millimeter and submillimeter electromagnetic waves. Dr. Koji Mizuno leads the research laboratory where recent research focuses on the development of millimeter-wave imaging systems, such as passive imaging arrays, and near-field microscopes utilizing tapered waveguide probes. The goal of the passive imaging array system development is to construct a millimeter-wave "camera" incorporating arrayed compact and dense two-dimensional receivers that can sense the small millimeter wave signals which radiate from objects. The group's near-field microscope development objective is to develop a system to examine the electrical constants of materials (e.g. dielectric constant) with high resolution. The waveguide probe approach facilitates higher resolution measurements than conventional incident wavelength microscopy. Future applications of these technologies are plasma diagnostics in nuclear fusion and mapping of defect (i.e. carrier) distribution density in dielectric substrates.

Development of high aspect ratio fabrication methods using SU-8 resin to support the terahertz engineering work is also being performed in the laboratory. The photochemical based process yields structures over 300 microns tall with feature resolution greater than 15 microns. This process yields tall structures at a fraction of the cost of other fabrication methods such as LIGA. The SU-8 fabrication process has been used to form waveguides, key components in submillimeter wave systems. The waveguide research was carried out jointly with the National Aeronautics and Space Administration's Jet Propulsion Laboratory at the California Institute of Technology located in the United States and the Central Laboratory of the Research Council's Rutherford Appleton Laboratory located in United Kingdom. (Pokines)

Site Visit: The Centre for Remote Imaging, Sensing, and Processing (CRISP), National University of Singapore (NUS), Singapore; 20 Apr 99:

Remote sensing is the technology of imaging the earth by satellite from space. CRISP, established in 1992 by NUS, is tasked with developing remote sensing to meet the operational, business, and scientific needs of Singapore and the region. A national center funded by Singapore's National Science & Technology Board (NSTB), its core technology is remote sensing data processing techniques (sensing, imaging, and interpretation). Its main activities support regional purposes such as forest, vegetation, and water resource development, mapping, civil engineering projects, ocean and coastal studies (e.g., sea conditions and ship movement).

Directed by NUS Professor Hock Lim, it has ambitious research programs in each of these areas. For example:

1) CRISP uses optical and synthetic aperture radar (SAR) images in complement for landuse classification. Spectral information from optical images is combined with coherence data from SAR (synthetic aperture radar, microwave images),
2) Multitemporal composite SAR images are used to track rapid changes in landcover that occur, for example, in river valleys, over single growing seasons,

3) Algorithms for digital land elevation models based on SPOT (visible and IR spectral regions) and SAR (microwave) stereopairs are under development.
4) Oil pollution is easily monitored using ERS SAR (microwave) images, because a sea surface smoothed by oil (e.g., ships discharging oil) results in reduced radar backscatter.
5) Images captured by SAR map internal wave structure, the amplitudes of which often are so extraordinary that they disrupt ocean operations.
6) Interferometric coherence data derived from SAR images are used to detect landcover types.
7) Algorithms for ship detection based on SAR images.

CRISP's research programs are augmented by collaborations with internationally renowned research organizations. Lastly, CRISP has established a satellite ground station at the NUS campus. The station's high-gain tracking antenna, with a 13-meter diameter dish, is one of the largest in Asia. It receives satellite data from Landsat, SPOT, ERS, and RADARSAT and processes the data into products for distribution to users. Images, location maps, and information are provided at http://www.crisp.nus.edu.sg. (Maurice)

Window on Science: Dr. Mineharu Kinugawa, NEC Corporation, presented a seminar to AFRL Information Directorate, 7-8 June 1999:

Dr. Mineharu Kinugawa, a well-known expert in the field of Ballistic Missile Defense, Simulation and Computational Simulation presented a seminar at the AFRL Rome Research Site. Dr. Kinugawa's presentation, "Timeline Models which Identity Critical Nodes for C2 (Command and Control) Battle Management to Theater Missile Defense," was based on work being done for the Japanese Ballistic Missile Defense Study Office. He described an approach that enables an optimum design for the communications network, one of the most important elements of C2 Battle Management. The method uses simulation technology. It is essential to implementing architecture of entire missile defense. POC: ***Dr. Heather Dussault,*** Information Directorate, AFRL/IFS (email: dussaulth@rl.af.mil). (Gaudreault)

Window on Science: Dr. Bazarin Bekhtur and Dr. Togoohuu Bayaraa, Research Centre of Astronomy and Geophysics (RCAG) of the Mongolian Academy of Sciences, visited University of Arizona and attended the AMOS Technical Conference, 25 Aug - 3 Sep 1999:

Dr. Bazarin Bekhtur and Dr. Togoohuu Bayaraa visited Prof. Robert McMillan an AFOSR grantee of the Spacewatch group at the Lunar and Planetary Laboratory, University of Arizona. During the visit, a preliminary agreement to cooperate in observing Earth-approaching asteroids was reached. The observations are to be made in the Mongolian Astronomical Observatory within the framework of the Spacewatch Project. Automation of the Observatory's telescope, Refractor - Kude, will be necessary. The Mongolian Astronomical Observatory provides the Spacewatch Project with a 12 hour time difference between America and Mongolia, a large percentage of clear nights, a dry climate, and very few observatories in the same range of longitude. Consequently, observation of significant asteroids can be carried out continuously for 24 hours. POC: ***Maj. Paul Bellaire,*** AFOSR/NM (email: paul.bellaire@afosr.af.mil). (Gaudreault)

Liaison Report Abstract

In response to requests from USAF scientists and engineers, AOARD has prepared the following overview report. They are available to USAF and other US government employees. Contact AOARD if you have an interest.

News: Progress of Japanese Satellites

Two government organizations are developing Japanese satellites separately. Due to the limited Japanese government budget for space research projects and recent consecutive failures for launching vehicles, Japanese satellite projects are at the crossroads. Reconnaissance satellites are the most urgent topic. (Miyazaki)

Conference: 2nd International Conference on Unsolved Problems of Noise and fluctuations (UPoN '99), Adelaide, Australia, 11-15 July 1999:

The effects of noise are particularly noticeable when signals are amplified. But, even under equilibrium conditions, all systems exhibit ubiquitous fluctuations that set limits on the performance of devices, technologies, and systems in any high-tech application. Although noise is usually considered a deleterious effect, participants at the thought-provoking UPoN '99 that convened in Australia presented intriguing work on its constructive effects as well, the study of which, is rich in multidisciplinary

applications in systems everywhere ranging from signal processing and biology to econometrics and cosmology. The full article is available at the AOARD Homepage **UpoN '99**

Reassessing concepts and theories in light of the many notions presented at UPoN '99 may hold striking implications that potentially transform our view of the cosmos. (Maurice)

Window on Science: Media Integration & Communication Researchers Drs. Ryohei Nakatsu and Naoko Tosa of the Advanced Technology Research (ATR) International, Kyoto, Japan, presented seminars to AFRL/ Information Directorate (IF), August 16, 1999:

The Information Systems Division of the Information Directorate (AFRL/IFS) hosted Drs. Ryohei Nakatsu and Naoko Tosa of ATR Media Integration & Communications Research Laboratories for seminar presentations on advanced multimedia integration concepts in August.

Dr. Nakatsu, President of the ATR Media Integration & Communications Research Laboratories, introduced the overall research activities of the Labs, emphasizing their key research issue -- a focus on the treatment of nonverbal information processing, such as facial expressions, gestures, emotions in speech, and so on. The Lab's work is geared toward the realization of "hyper communications." This means the merging of the artificial intelligence of machines-with-a-human-interface and those patterns of communication that are nonverbal. An ATR program objective here is, for example, to communicate compressed, converted, and transmitted image and gesture data. The challenge is to ultimately provide participants with a realistic feeling of "being there." The necessary fusion of natural speech rhythm and speed with natural eye motion characteristics is paramount to a merging of art and technology.

Dr. Tosa -- artist, researcher, and Invited Professor at Kobe University -- presented her recent activities on the ATR Interactive Cinema Project she directs. Dr. Tosa's cyberspace concept has been demonstrated at graphics exhibitions around the world and most recently at SIGGRAPH on the West Coast. Features of her unique "theater-media" cyberspace include emotional contexts and an interactive story that is authored in real-time with any-time interactions. To realize "consciousness interaction" in this cyber situation, her system integrates several multimedia data module technologies. The data-fused modules include 1) speech recognition, 2) emotion recognition, 3) gesture recognition, including touch, 4) image and 5) sound processing, and, finally, 6) motion capture. In a related project at ATR, Dr. Tosa interactively synchronizes speaker ("actor") interest-level and strain-relaxation level.

Their presentations were followed by active discussions on the importance of integrating nonverbal information (such as physical and mental experience) in human-computer communications, such as would be encountered in a Virtual Reality scenario. In such an immersion environment, communication becomes an integrated experience. The clearly advanced concepts presented by Drs. Nakatsu and Tosa point towards highly effective data fusion and just such a situational awareness tool. POC: ***Dr. Richard Slavinski, AFRL/IFSA*** (Maurice)

Aerospace & Materials

Site Visit: Next Generation of Materials and Devices for Actuators Under Development at the Institute of Fluid Science, Institute of Fluid Science, Intelligent System Laboratory, Tohoku University, Sendai, Japan; 21 Sep 99:

Dr. Junji Tani, the Director of the Institute of Fluid Science at Tohoku University, also leads the Intelligent Systems Laboratory. This Laboratory is a participant in an Agency of Industrial Science and Technology (MITI) sponsored national project to develop active materials and intelligent systems involving university, industrial and government laboratories. Dr. Teruo Kishi of the University of Tokyo leads the national project. Other university project members include Professor Nobuo Tekeda (University of Tokyo, Center for Collaborative Research), Dr. Takehito Fukuda (Osaka City University, Department of Mechanical Engineering) and Dr. Yuji Matsuzaki (University of Nagoya, Department of Aerospace Engineering). The project is scheduled to run from FY 1998 to FY 2002. The goal is to develop basic technologies to improve and realize active materials, composite structures, and intelligent systems. The four themes of the research project are: health monitoring, smart manufacturing, active and adaptive structure technology, and materials and devices for actuators.

Dr. Tani leads development of materials and devices for the actuators team. The research conducted in the Intelligent Systems Laboratory is focused on the improvement and development of active materials such as

piezoelectric ceramics and shape memory alloys. Thin films, wires, and functionally graded active materials are under development. Hybrid active material systems are also being investigated. The research goal is to improve strength, active strain, and response time of materials and incorporate the improved materials into composite structural systems. Joint applied research with industrial partners (e.g. automobile & piezoceramic manufactures) who supply active system applications and technical assistance are providing a pathway to reduce product development time.

The Intelligent Systems Laboratory is involved in other research projects in addition to the materials and devices for actuators program. Researchers are studying the control and analysis of flow-induced vibrations, applications of functional fluids such as liquid crystals, electrorheological fluids, and magnetic fluids, and the simultaneous optimization of structural and active control systems. (Pokines)

Site Visit: Nihon University, Mechanical Engineering Department, Chiba, Japan; 21 June 1999:

Nihon University is the largest university in Japan with 15 graduate schools, 11 colleges, and a junior college. More than 87,000 students are enrolled with over 8,300 teaching and administrative staff. In addition, there are over 20,000 students in the university affiliated junior and high schools. The unique feature of Nihon University is that each of its colleges has its own campus equipped with library, athletic, and research facilities. Therefore, all colleges are fully able to function as independent institutions.

Prof. Goichi Ben heads a composite laboratory in the College of Industrial Technology. His research involves using computer algorithms and analytical modeling tools to predict behaviors of composite structures. Recent research includes modal-based structural damage detection and optimization of thick composite shell under pressure by using a genetic algorithm. Advanced composite structures are desirable due to their excellent strength and stiffness-to-weight ratio. However, composite structures are susceptible to damage caused by impact loading of various foreign objects and careless handling by workers. For example, one individual might drop a composite pressure vessel without any external damage. The structural damages due to inter-laminar delamination or small fiber-matrix debonding that occurs in the composite structures are not noticeable. Eventually, this damage (or crack) in the structure grows and leads to a structural failure. Currently, there are several damage detection methods available such as ultrasonic crack detection, wave propagation and scattering, modal testing, and others. Prof. Ben's model-based damage detection technique relies on vibration test data and strain gauge records. The damaged location is estimated by three localized flexibility changes in composites or the changes in the global stiffness properties. The numerical predictions are compared with the experimental results, which indicates that the localized flexibility changes yield accurate identification of damage location and the damage level. This kind of research could lead to a cost effective and reliable damage detection system for aging aircraft and launch vehicle systems. (Kim)

Site Visit: Soongsil University, Department of Chemical Engineering, Seoul, Korea; 14 Sep 1999:

Soongsil University was established in 1887 during the Yi Dynasty period in Pyongyang, North Korea. A missionary named Dr. W.M. Baird was sent by the Northern Presbyterian Church of America to disseminate western ideas and knowledge throughout the country. In 1950, due to the Korean War, this university was forced to flee to south re-establishing in Seoul three years later. Currently, there are 8 colleges and 8 departments with 12,000 students enrolled. Prof. Wansoo Huh in the Department of Chemical Engineering is studying polymer blending and composite materials. The cyanate ester resins (thermoset) have been used in space structural application for their excellent mechanical properties and durability against severe space environments. This system also has been used as an encapsulant for electronic devices due to its excellent thermal and adhesive properties. However, its uses are limited to few applications because of inherent brittleness. To toughen this highly crosslinked polymer, researchers have employed rubber toughening without much success. One approach to toughening this resin was by physical blending it with thermoplastic resin systems such as polyetherimide (PEI) or polysulfone (PSF). In thermoset/thermoplastic blending, the fracture toughness is determined by the morphology formed by the consequence of phase separation. Prof. Huh investigated the phase separation behavior of cyanate ester rein/polysulfone blends. His results showed that the composition of the blends and the curing temperature affect the morphology of the blends and the phase separation mechanism. The phase separation depends on the viscosity of the medium at the initial stage of phase separation and was determined by the amount of thermoplastics and the cure temperature.

Prof. Huh also worked on Korea's current development of a high speed train. When completed in 2010, this bullet train will transport passengers from Seoul to Pusan (412 km) in about 2.5 hours at a top speed of 300 km/hr (Currently, it takes about 4 hours to Pusan). Most of the train's main components are manufactured by the TGV of France under a $2.1 billion contract but it will be assembled in Korea incorporating indigenous parts. Prof. Huh investigated the suitability of various material systems for the train body shell and interior floor panels. By using a carbon/epoxy composite system on a train body shell, lower weight and operating cost can be realized. He also determined that composite honeycomb sandwich panels are best suited for interior structures such as the floor, ceiling, and overhead compartments because of better protection against fire, noise, vibration, and corrosion. (Kim)

Window on Science: CFD Researcher, Prof. Kozo Fujii, The Institute of Space and Astronautical Science, presented a seminar at the AFRL Air Vehicles Directorate, 7-8 July 1999:

One of Japan's premier computational fluid dynamics (CFD) researchers, Prof. Kozo Fujii, gave a seminar lecture on the "ISAS Effort in Computational Fluid Dynamics" at Wright-Patterson AFB, Ohio. He discussed methods that ISAS is using to overcome some of the obstacles encountered in CFD. Using real world, contemporary examples, Prof. Fujii showed how using a moving grid could increase spatial resolution, how considering the basic equation and finding a good mathematical model under the given computer resource limitation can help overcome the problem of limited computer resources and how using Cartesian grids wisely can handle complex geometrical configurations. He also discussed how new types of post processing might be important in dealing with future unsteady flow simulations. (ISAS home page: http://www.isas.ac.jp/)
POC: ***Dr. Joe Shang,*** Aeromechanics Division, AFRL/VAA (email: shang@vaa.wpafb.af.mil). (Gaudreault)

Electronics & Optics

Conference: 7th Microoptics Conference (MOC'99) and 8th International Plastic Optical Fiber Conference (ICPOF), Nippon Convention Center, Chiba, Japan, 14-16 July 1999:

The biennial MOC '99 and 8th POF Conferences convened this summer in Japan with well over 300 participants from around the world. MOC is sponsored by the Japan Society of Applied Physics in cooperation with several academic societies and technical associations, including Army Research Office Far East, (AROFE), Office of Naval Research International Field Office, Asia (ONRIFO-Asia), and AOARD. Its focus is on microoptic devices such as lenses, waveguides, lasers, and photodetectors. The co-located ICPOF, which also occurs in cooperation with several academic societies and was also Triservice supported, featured leading experts worldwide in POF and covered a wide range of materials, devices, and systems.

Optics is key to the information age. Global Internet traffic is exploding, with 200,000,000 e-commerce users expected by about the time year 2000 arrives, demanding ever-higher data rates and hence *bandwidth*. Singapore and Korea, by high-speed optical fiber cable modems, are linking homes in a way that many social and economic activities can occur through multimedia networks. Japan is a bit behind here. But the major issue concerning all is bandwidth, with backbones already overloaded. The demands are being met by high-functionality, integrated photonics. With the need to establish new data links and networks, much due attention is on both microoptics and POF. Light offers huge bandwidth, parallelism, action-at-a-distance, and strong, controlled interaction with materials. Further solutions to solve the bandwidth jam are being offered by wavelength division multiplexing (WDM) and what has been coined QOS for "quality of service." WDM is a wavelength conversion technique that is solving the transmission challenge by its use of several wavelengths of light as channels, combining them losslessly, and simultaneously transporting them as independent data streams. At current international conferences as these, WDM now appears to have the advantage over other methods (see ASL 17).

ICPOF chair and MOC'99 co-chair was Dr. Y. Koike of Keio University. His group presented recent work on large-core (200-1000 μm), high-bandwidth, low-loss graded-index perflourinated (PF) polymer-based POF. This POF enables the use of low-cost connectors that also eliminate modal noise, thus improving bandwidth characteristics. In the area of optoelectronics, Dr. K. Iga presented an honorary plenary on vertical cavity surface emitting lasers (VCSELs). Prof. Iga and coworkers at Tokyo Institute of Technology first conceived and demonstrated surface emitting lasers (SELs) and planar microlens arrays -- indeed, proposing them at an MOC several years prior. In his plenary, he surveyed current VCSEL activity in the infrared to UV spectral bands: 1)

long-wavelength VCSELs (GaAs based) for fiber communications (for example, at Hitachi Central Research Labs, GaInNAs lasers grown by metal-organic chemical vapor deposition (MOCVD)), 2) blue-green VCSELs (ZnSe, ZrO/SiO_2, and GaInN based), useful in laser printers and high-speed, high-density optical storage systems (such as laser disks), and 3) UV lasers based on GaN. Japan's superior VCSEL work is characterized by large area output powers (>100 mW), mega-lifetimes, and high efficiencies (up to 60%). Efficient red-green-blue VCSELs will inevitably create whole new markets for semiconductor laser-based full-color displays.

VCSELs are capable of gigabit/second multimode fiber transmission. They can substantially reduce system cost (chip, module, and package). Proposed at the joint MOC and POF sessions was that advanced POF systems *require* VCSELs. That, in particular, long wavelength VCSELs employing hybrid mirrors (a mirror that includes both semiconductor and dielectric distributed Bragg reflectors) may form a high-end, temperature controlled, simplified key device for high-end parallel networks and datacom links. (Maurice)

Site Visit: Kyung Hee University, Department of Chemical Engineering, Yongin, Korea; 14 Sep 1999:

Kyung Hee University is a private, coeducational university founded in 1949. Today, there are three separate campuses in the vicinity of Seoul. The Department of Chemical Engineering is located on the Suwon Campus with nine full-time professors and more than 300 undergraduate students and 40 graduate students are enrolled. Prof. Ki-Kook Song is currently developing an innovative liquid crystal alignment method to enhance liquid crystal display (LCD) production. Unlike the bulky cathode-ray (CRT) display, the LCD can play an important role in everyday applications due to reduced display size, weight, and power requirements. However, there are a few difficulties associated with LCDs. The present felt-rubbing technique could create problems such as narrow-viewing angle and slow response time. It could also cause electrical and mechanical damages to the underlying thin-film transistors (TFT). One alternative is to use a liquid crystal alignment on photosensitive polymer film that does not contact with TFT and may produce multi-domain structures. However, these molecular level interactions of LCM are not known at this time. To understand this interaction, Prof. Song uses vibrational (infrared region) spectroscopy to determine the mechanism of LC alignment on a polymer surface. By using the IR spectroscope, the molecular shape of stretched polymer structure can be viewed at yield point. His preliminary findings suggest that the LC alignments were induced through intermolecular interactions between polymer and LC molecules. (Kim)

Window on Science: Chitose Institute of Science and Technology (CIST) President and Professor Dr. Naoya Ogata, Chitose, Hokkaido, Japan to AFRL Directorates, September 1-2, 1999:

Dr Naoya Ogata of CIST presented seminars on "Bioconjugate Materials for Intelligent Sciences" to receptive researchers at AFRL/AFOSR in Arlington, VA, and the HE, SN, and ML Directorates at WPAFB.

Dr. Ogata, an established molecular chemist, has considerable expertise in the design, synthesis, and characterization of organic molecules. As CIST President and Professor, the focus of his work at the newly established photonics Institute (see ASL 19) is on applications that exploit the electrical and optical properties of organic materials. At the AFRL sites, he first introduced his concept of intelligent and bioconjugate materials with research results on enzyme modifications by temperature-sensitive polymers. This novel idea allows for enzyme recovery and re-use as follows. Certain temperature-sensitive polymers are soluble in water, but below critical temperatures become insoluble. Surface modifications of enzymes by the polymers make it possible to later precipitate the enzymes out of the reaction phases, thereby recovering them for reuse. He also described recent endeavors on novel optical materials based on DNA derived from salmon sperm. The easily extracted DNA supramoloecules are an interesting molecular material with molecular weights of over 1 billion -- something no synthetic polymers can achieve. Though the molecules can be hydrolyzed in a wet state, they are quite stable when dry (why we hear about dinosaurs born from fossilized DNA remains). Salmon DNA is water-soluble but becomes water-insoluble when sodium ions (from DNA sodium atoms) are replaced with common lipids. The then-DNA-lipid complexes are soluble in organic solvents such as benzene, ethanol, and chloroform, and can easily be fashioned into films, etc., by simple casting methods. The DNA maintains its double-helical structure. Within this structure, optically active molecules, for example, can be stacked or "intercalated." Dr. Ogata provided several samples of CIST-designed-and-synthesized dye-intercalated DNA films. Much discussion of structures and properties followed his seminars. This use of salmon-derived DNA as a raw material for industrial applications in advanced sciences is

quite unique and creative. POCs: Dr. Charles Lee AFRL/AFOSR/NL and Dr. Brian Tsou, AFRL/HECV. (Maurice)

Liaison Report Abstract

In response to requests from USAF scientists and engineers, AOARD has prepared the following three overview reports. They are available to USAF and other US government employees. Contact AOARD if you are interested.

1) **The present status of COIL laser at Kawasaki Heavy Industries (KHI)**

KHI has been developing the Chemical Oxygen Iodine Laser (COIL) for 12 years. The COIL is suitable for generating high power, but has several serious technical problems for commercial availability. KHI is focusing on applications to welding system. (Miyazaki)

2) **Industrial Laser Development in Japan**

Key technologies of laser processing in next generation include Laser Diode (LD), LD pumped solid-state laser, high power and high quality CO2 laser, and excimer laser. Applications of these lasers are extending toward a wide variety of manufacturing processes. Recent R&D targets are aimed at high speed and high precision processing, high density mounting, novel processing methods and flexible processing. (Miyazaki)

3) **R&D of Fiber Lasers in Japan**

For realizing high output power of fiber lasers, three different approaches have been tried. The first is modularization of multiple laser diodes (LD) and combination with erbium doped fibers. The 20 LD modules showed maximum power of 1.5W. The second is the combination of pumping LD and fiber grating; Sumitomo Electric Industries Ltd. succeeded in realizing more than 1.5W for 8 wavelengths. Third, novel fiber laser structures have been developed under a government project; "Structure-type fiber laser" and "Bundle type fiber laser". The maximum intensity is expected to be over 100MW/cm2. (Miyazaki)

Human Systems

Conference: 1999 Progress in Electromagnetic Research Symposium (PIERS '99), Taipei, Taiwan, 22-26 March 1999:

PIERS '99 covered a broad range of topics in electromagnetics and their applications in 750 papers from 45 countries. Included in the 80 concurrent sessions were sessions on Biomedical Imaging & Visualization, Cancer Treatment, and Medical & Biological Applications of EM. The Technical Session on Medical and Biological Applications of Electromagnetics was chaired by Dr. C.K. Chou, of Motorola, USA. Eleanor R. Adair, Ph.D., Senior Scientist, Electromagnetic Radiation Effects, at AFRL/HEDR presented an invited paper on "Altered thermophysiological responses in human volunteers exposed to radio frequency (RF) fields in controlled thermal environments." The paper was extremely well received. Japanese research on the medical applications of microwaves (including the hyperthermia treatment of cancer and microwave coagulation therapy) was presented by both the Faculty of Engineering of Chiba University and by Tokai University. Dr. Adair subsequently had extensive technical discussions with Dr. Koichi Ito, Professor, Antenna Laboratory, Chiba University. POC: Dr. Eleanor Adair, AFRL/HEDR. (Lyons)

Site Visit: Korean Brain Science Research Center, Korea Advanced Institute of Science and Technology (KAIST), Taejon, Korea, (Dr. Soo-Young Lee, Director, 9 September 1999:

The Korean Brain Science Research Center is centered at KAIST in Taejon, although research is conducted at many institutions throughout Korea. Korea has a sizeable investment in brain science with 100 professors and 325 graduate students and a budget of approximately $10 million per year (not including facilities and salaries). This is a relatively new investment in this area (began in approximately 1998). The goals of the Korean effort are to apply research in molecular, and cognitive, behavioral science to the development of mathematical models of the neuron, hardware such as neural chips with learning capability, and autonomous control devices. Upcoming conferences and workshops are listed in "Upcoming Conferences in Asia" in this Newsletter. (Lyons)

Site Visit: Kanazawa Institute of Technology (KIT), MATTO Laboratories for Human Information Systems (Professor Ryoji Suzuki, Director); 23 June 1999:

The MATTO Laboratories are located in Kanazawa City a few kilometers from the main campus of KIT, which is a private technical university and the largest such institution in Japan specializing in engineering and Technology . Although KIT is a privately funded University, research at the MATTO laboratories are funded directly by the Ministry of Education. The MATTO Laboratories, with 8 full-time professors, are conducting research in the following: 1) non-invasive measurement of brain function and inverse problem for signal source prediction, 2)

development of advanced measuring technology such as superconducting quantum interference devices (SQUID), 3) designing media environments for human comfort including studies of visual, auditory, and vestibular interaction, 4) robotics/autonomous vehicles, 5) designing an autonomic system based on ethnological principles of living organisms through the study of the cricket hormonal system, and 6) visual information processing in the brain including mental mapping and situational awareness. (Lyons)

Site Visit: Doshisha University, Department of Mechanical Engineering, The Motion and Vibration Control Laboratory (Professor Takayama Koizumi): 25 June 1999:

In the Department of Mechanical Engineering human factors research was integrated into various projects. The Motion and Vibration Control Laboratory with 2 professors and 20 graduate students conducted research on vibration analysis, structural/human dynamics, kinematics, and noise/vibration reduction. Along with research on vehicle suspension was research on vibration and human comfort including a simulation of the vibration characteristics experienced by passengers on high speed trains. Another interesting research project involved evaluation of the dynamic performance of golf clubs and golf swings. Also within this department was research on both noise reduction of engines and active noise reduction technology. (Lyons)

Window on Science Visit: Dr. Masao Taki and Mr.Yoshiaki Watanabe, Department of Electrical Engineering, Tokyo Metropolitan University visited AFRL Human Effectiveness Directorate, Radio Frequency Radiation Branch at Brooks Air Base, Texas on 23 August 1999:

Dr.Taki is a member of the International Commission on Non-Ionizing Radiation Protection (ICNIRP) and the Japanese Committee responsible for Radio Frequency Radiation (RFR)/Electromagnetic Field (EMF) Guidelines in Japan. Research is underway studying EMF and induced electrical fields. Dr Taki is also very interested in the special biological characteristics of pulsed RFR fields and will be increasing his research in this area, including a special emphasis on the microwave hearing phenomenon. Mr. Watanabe briefed his research on microwave auditory effects using anatomical models of the human head. Dr. Taki gave a presentation on his research on "Dosimetry on Sensory Effects of Electromagnetic Fields." Additional subjects covered included: 1) Dr. Taki's study of the effect of local exposure of the brain to 7.5 W/kg showed no increased permeability of the blood-brain barrier, 2) various novel applications of mm.-waves (wireless LAN, wireless TV, etc.) planned by the Japanese Ministry of Post and Telecommunications may require additional research to allay public concerns. POC: Dr. Michael Murphy, AFRL/HEDR. (Lyons)

Conference: The 4th Asia-Pacific Conference on Medical & Biological Engineering, Seoul, Korea, 12-15 September 1999:

About 800 participants from approximately 40 different countries attended this conference, presenting over 400 scientific papers. Many regional experts on the biological effects of electromagnetic fields (EMF) were present and several papers were presented. Based on research conducted in Japan, Dr. Nojima, from NTT DoCoMo (Cellular phone Division), gave an excellent overview on the potential for effects of electromagnetic interference on medical devices and aircraft. Dr. Yoon-Won Kim, Professor and Director of the Institute of Medical Science, Hallym University, Chunchon, Korea presented the results of his research on 60 Hz animal exposure as well as a general overview of the effects of electromagnetic fields on health. Two speakers from Sichuan University in Chengdu, China also presented research on EMF: Dr. B.Y. Wang's study of the membrane effects of weak transient electromagnetic pulses indicate that weak periodic EMP can have more biologic effects than continuous wave and Professor Kama Huang, Dean of the College of Electronic Information, described an experimental device designed to ensure uniform and predictable EMF exposure to in-vitro test tube experiments. (Lyons)

Liaison Report Abstract:Pit Viper Infrared Vision

AFOSR has supported some interesting research on pit viper infrared vision. The work of Dr. Shin-Ichi Terashima (University of the Ryukyu's) and Dr. Richard C. Goris (Yokohama City University) comprises perhaps half of the world's literature on this subject. It consists of anatomical and physiological research with the goal of understanding the processing of infrared sensory input by the peripheral and central nervous system. Both of these researchers have been supported by AFOSR grants managed, initially by Dr. Pat Roach (now at USUHS) and subsequently by Dr. Larkin (AFOSR). The most recent grant to Dr. Terashima has the goal of understanding the molecular mechanism of IR detection.

Concerning the capability of the pit viper IR system, apparently it can discriminate .002 -.003 degrees

temperature differential between target and background and the snake can strike with a high spatial accuracy - average within 5 degrees of the target. The snake is difficult to test – it needs to be blindfolded, will not strike at inanimate (stationary) objects, etc. But the real advantage of the snake system is its small size and ability to operate at ambient temperatures (man-made systems require cryogenic cooling). Also motion apparently helps the snake to differentiate interesting targets. Another interesting aspect is that, in the snake, visual and IR sensory input are integrated - evidently mapped on to the same locations on the cerebral cortex. So the snake uses more visual input in daytime and more IR input at night, but actually uses both systems continuously in a seamless manner.

A total of 35 articles by Drs. Goris and Terashima have been published in two books. AOARD supported the publication of the second book.

1. Infrared Sensory System, ed S. Terashima, University of the Ryukus, Okinawa, 1987.
2. Infrared Receptors and the Trigeminal Sensory Receptors, ed. Shin-Ichi Terashima and Richard C. Goris, Harwood Academic Publishers, 1998.

See the AOARD website for an article on INFRARED SENSING FROM A BIOLOGICAL PERSPECTIVE, by Richard C. Goris, Ph.D. of the Yokohama Foundation for Advancement of Medical Science in Yokohama, Japan. (Lyons)

Technology Management

Feature Article: KOREA'S INVESTMENT IN RESEARCH AND DEVELOPMENT

Investment in research and development are important national goals for Korea which has the stated aim of joining the ranks of the developed nations by early in the next century (5). Between 1980 and 1996 Korea dramatically increased its R&D investment from 283 billion won or 0.77% of GDP (only about $250 million U.S.) to U.S. 5 billion in 1990 and to 10.878 trillion won or 2.79% GDP (almost U.S. $ 10 billion) by 1996 (2,5). Although this is a dramatic increase, it is still small in absolute terms compared to the U.S. (almost $200 billion in 1996) and Japan ($140 billion)(4). Prior to 1997 Korea had planned to increase its research spending from 2.5% of GDP to 5.0% by early in the next century. By way of comparison the U.S. expends approximately 2.5% of its GDP on R&D and Japan expends 3.0% (highest of any nation in the world). The economic crisis of 1997, however, has had a severe impact on Korea's plans (2,4,5).

In Korea the industrial sector has been responsible for a high proportion of the countries total R&D investment (80%). The government funded share of Korean R&D (19%) is lower than that of Japan (21.2%) which is in turn lower than that of the: U.S.(32.5%), the United Kingdom (33.3%), Germany (37.1%), France (43.2%), and Russia (60.5%). With the IMF crisis in Korea, this industrial research funding was vulnerable to cutbacks.

The training of researchers has been given a high priority in Korea, where the number of R&D personnel has more than doubled over the past decade from 10.1 to 29 per 10,000 population (1,2). Asiaweek's annual survey now puts the Korea Advanced Institute of Science and Technology (KAIST) and Pohang University of Science and Technology as #1 and #2 among all of Asia's S&T schools (3). A problem in Korean research is the misalignment of monetary and manpower resources with industry expending 72% of the research dollars, but able to employ only 9% of the Ph.D. level scientists (2). University positions are seen as more secure and prestigious.

In R&D outcome metrics, Korea has also demonstrated steady improvement. Korea's patent applications have increased almost ten-fold over the past decade bringing Korea to a rank of #5 in the world in patent applications (2). The Korean share of total S&T publications has also been steadily increasing from 32nd in the world in 1990 to 24th in the world by 1996 (2,5).

Korea has tried to focus its research efforts in order to become competitive in certain limited areas. For example, according to the Samsung Advanced Institute of Technology Korea's capability in the area of flat panel displays is approximately 80% that of Japan (2). The Korea Ministry of Science and Technology (MOST) maintains its goal of reaching the level of the G-7 countries in S&T by early in the next century (1). (Lyons)

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1. Korean Ministry of Science and Technology Homepage.
2. Dr. Kwan Rim, "Biomedical Engineering: Korean Perspective", Keynote Address at the 4th Asia-Pacific Conference on Medical and Biological Engineering, 13 September 1999.

3. Murakami Mutsuko, "Designs on the Future", Asiaweek, April 23, 1999: p-56-59.
4. Ueda, Atsuo (ed.), Japan 1999: An International Comparison, Keizai Koho Center, 1999.
5. Valigra, Lori, National Project Aimed at Making it the Leading Tiger, Nature, Vol 3644, #6436, 29 July 1993.

News: Brain Korea 21 (BK21) Initiative to Increase Advanced Degree Graduates in Science and Technology

Korean Ministry of Education started a seven-year program called BK21 to increase the number of Ph.D.s in applied science, the publication of scientific papers, and patent applications. Korea hopes that this initiative will enable its universities to compete with the world's renowned institutions and to further its goal of becoming one of the top ten most scientifically productive nations. The government feels that this initiative will train more graduate students within Korea, save money by sending fewer students abroad and reduce "brain drain" when students do not return to Korea upon graduation. The annual budget of BK21 will be about $200 million with funding in seven major science fields: material science, information technology, biotechnology, mechanical engineering, chemical engineering, physics, and chemistry. Besides funding research projects, government plans to reduce the number of undergraduates in those departments receiving BK21 grants (relieving heavy undergraduate teaching loads). By being teamed up with the universities awarded grants, the non-elite universities or the provincial institutions may benefit by increase in student enrollment. Although, a few universities (3 universities in each field) will be well funded, many institutions without BK21 funding may find their research funding declining and increased difficulty attracting top students. To counter this problem, government mandates that half of the graduate students admitted to a new research program must come from universities not receiving a BK21 grant. The majority of BK21 grant has been awarded to Korea's top three S&T universities: Korea Advanced Institute of Science & Technology (KAIST), Pohang University of Science & Technology (POSTECH), and Seoul National University (SNU). The competition for entry into these top universities may be even greater due to limited undergraduate slots. In departments not having BK21 grants, some fear that many top students will shun their departments. Others ask by producing more graduate students, how is the government finding productive research employment in these tough economical times? By producing more graduate students, how is the government finding productive research employment in these tough economical times? For the past three years (following IMF intervention), many industries have not hired graduate students. In some cases, research centers have been closed due to lack of funds. The critics also charge that government is putting too much emphasis in applied research instead of basic research. However, the government's vision for the 21st century is to lead Korea into one of the most technological advanced societies in the world. (Kim)

News: Special Report on S&T Education in Asia

According to *Asiaweek* (April 23, 1999) survey of top Asian science and technology institutes, Korea Advanced Institute of Science and Technology (KAIST) was ranked No. 1. The focus of KAIST is in the latest advances in S&T by more than 4,100 graduate students and about 2,400 undergraduate students. The annual budget of KAIST is about $130 million. The 2nd in ranking was another Korean university the Pohang University of Science and Technology (POSTECH) with enrollment of about 1,250 undergraduate and another 1,200 graduate students. This private institution was founded by Pohang Iron and Steel Company thirteen years ago. The annual budget of POSTECH is around $100 million. The 3rd on the ranking was the Tokyo Institute of Technology with 4,100 graduate and 5,700 undergraduate students. This "hands-on" approach university was started as a vocational school in 1881 and the current annual budget is around $300 million. (Kim)

Site Visit: Japan Key Technology Center (JKTC)

The Japan key technology Center(JKTC), Tokyo, Japan was set up in 1985 to provide comprehensive services to assist in promoting R&D in key technology. This would be done in collaboration with government, industry and academic concerns. The JKTC provides loans for R&D by private concerns and invests in joint R&D companies set up by private concerns in order to promote R&D by the private sector in key technologies. It also coordinates joint research with national research institutes, invites overseas researchers, disseminates valuable research data held by government affiliated bodies, and conducts various surveys related to key technologies. Funds for JKTC are derived from the Japanese government's equity holdings and annual dividends in Nippon Telegraph and Telephone Corporation(NTT). The level of government funding has been constant for several years (approximately 28.5 Billion-yen per year). Since its inception, JKTC has funded 109 investment projects with 47 projects completed and 87 on-going. Most of JKTC projects are grouped into two major categories: physical sciences and biotechnology.

In physical science, the Advanced Telecommunications Research (ATR) laboratories represent the basic research end and Advanced Satellite Communications (ASC), Super Silicon (SSi), Mobile Telecommunications Key Technology Research Lab. (YRP) and Mixed Reality System Lab (MRSL) are developmental. ATR laboratories are well known for first class research in telecommunications, including visual and auditory research related to communications. For detailed information on ASC, refer to the previous ASL (Volume 21, pp.4 Sep-Oct 99). For the last several years, projects related to information technologies, including the telecommunications and the entertainment industries have been emphasized.

In biotechnology and life science, centers are focused on functional genomics, bio-informatics, bio-photonics and bio-molecular engineering. Bio-informatics is being pursued in the Helix Research Institute (HRI) and the Biomolecular Engineering Research Institute (BERI). Pragmatic centers include the Environmental Immuno-Chemical Technology Co. (EIT) and the Biophotonics Information Laboratories (BIL). Centers are now focusing on new areas such as genomics and bio-informatics.

JKTC officials regard patents and published papers as the major outcome metrics and strongly encourage firms to patent and publish results. JKTC projects have resulted in over 4,000 patents and 16,000 technical papers. However, there have been only a few new business startups. The return on investment in the form of licensing on patent sales in these projects is still far away. The Ministry of International Trade and Industry (MITI) is beginning to have doubts about the economic validity of the projects and JKTC officials note that they have to modify the system to take into consideration exclusive licenses.

For more information, contact JKTC (e-mail: jktcsoumu@jsn.justnet.or.jp). (Miyazaki).

News: Recent Developments in S&T in Taiwan: Speech by Chao-Shiuan Liu, Vice Premier of the Executive Yuan, Republic of China:

A high point of PIERS 1999 (see under Human Systems in this ASL for a description of the conference) was the opening address by Professor Chao-Shiuan Liu, Vice Premier of The Executive Yuan, ROC. He spoke about recent developments in science and technology in Taiwan in light of three major challenges to all the nations of the world. These are:

1) the global trend towards free trade that makes it difficult to protect domestic industry;
2) the growing calls for environmental protection and maintenance of ecological balance in the face of needs of a growing human population; and
3) the new "information society" that is creating a new culture in a world that is fast becoming a closely-knit global village.

He said that science and technology play a pivotal role in addressing these challenges and gave details of how sci-tech in Taiwan is meeting them. He spoke of the increase in funding for R&D from NT$38 billion in 1988 to NT$156 in 1998, growth of 1 to 2% of GDP. In the same time, the number of researchers with advanced degrees has increased from 25,000 to 55,000. Many world-class research facilities have been completed, publication rates of scientific papers are significantly increased, and technology-intensive industries account for 41% of all manufacturing output. On these bases, he outlined the agenda for the future development of science and technology. The caliber of researchers will rise and R&D expenditure will account for 3% of the GDP in 2010 with the private sector contributing 60% of the total. The goal is to make Taiwan one of the research centers of the Asia-Pacific region. A national research center of theoretical sciences is being established under the leadership of C.N. Yang and S.T. Yau. Four national programs are already approved: telecommunications, disaster mitigation, a human gene program, and agricultural biotechnology. Science cities will be developed, consisting of core science-based industrial parks surrounded by satellite industrial, software, or research parks. Science parks and major infrastructure projects will be linked with a high-speed rail system and modern telecommunications systems. Taiwan is committed to becoming a center of excellence in science and technology as well as an Asia-Pacific regional high-tech manufacturing center. This high-tech island will have a manufacturing output that exceeds US$300 billion by the year 2000 and 10 years later will be regarded as a "technologically advanced nation". (Dr. Eleanor Adair, Senior Scientist, Electromagnetic Radiation Effects, AFRL/HEDR) (Lyons)

Upcoming Conferences In Asia

These upcoming conferences may be of interest to you. Contact us for more details or check our homepage at http://www.nmjc.org/aoard/ Conferences in **BoldFace** are AFOSR/AOARD Sponsored.

Date	Name	Place
Nov 15-17, 99	**International Conference on Composite Structures (ICCS 10)**	**Clayton, Australia**
Nov 18-19, 99	**Composite Specialist Workshop**	**Melbourne, Australia**
Nov 24-26, 99	**1999 Int'l Symposium on Micromechatronics and Human Science**	**Nagaoya, Japan**
Nov 29-Dec1, 99	Int'l Symposium on Surface Science for Micro & Nano-Device Fabrication	Tokyo, Japan
Nov 29-Dec 3,99	**International Symposium on Photonics and Applications (ISPA'99)**	**Singapore**
Nov 30-Dec3, 99	Asia Pacific Microwave Conference (APMC)	Singapore
Dec 1-3, 99	The 6th International Display Workshops (IDW'99)	Sendai, Japan
Dec 5-8, 99	Ecohazard'99	Shiga, Japan
Dec 8-9, 99	**International Workshop on Fracture Mechanics and Advance Engineering Materials**	**Sydney, Australia**
Dec 9-10, 99	First International Workshop on Molecular Design of Photonic Materials	Takarazuka, Japan
Dec 15-17, 99	APCOM '99/4th Asia-Pacific Conf. on Computational Mechanics for the Next Millennium	Singapore
Jan 9-13, 00	Symposium on Energy Engineering in the 21st Century	Hong Kong
Jan 12-13, 00	**2nd U.S.-Korea Workshop on Brain Science-Cognitive and Behavioral Neurosciences**	**Taejon, Korea**
Jan 18-21, 00	10th International Toki Conference on Plasma Physics and Controlled Nuclear Fusion (ITC-10)	Toki, Japan
Feb 22-27, 00	Asian Aerospace 2000	Singapore
Mar 13-17, 00	**An Introduction to Using Anthropometry for Effective Solutions**	**Sarawak, Malaysia**
Mar 22-26, 00	Tokyo Aerospace 2000	Tokyo, Japan
Mar 27-30, 00	International Conference on Physiological and Cognitive Performance in Extreme Environments	Canberra, Australia
Mar 27-31, 00	12th International Conference on Ternary & Multinary Compounds (ICTMC-12)	Taiwan
Apr 12-13, 00	Photomask Japan 2000	Yokohama, Japan
May 7-12, 00	USARPAC Asia-Pacific Military Medicine Conference X (APMMC X)	Singapore
May 14-17, 00	The Fourth International Conference/Exhibition on High Performance Computing in Asia-Pacific Region (HPC-Asia 2000)	Beijing, China
May 22-25, 00	Fourth International Commission on Non-ionizing Radiation Protection (ICNIRP) workshop	Kyoto, Japan
May 23-26, 00	Advanced Underwater Technologies for the 21st Century	Tokyo, Japan
May 30-Jun 15, 00	International Conference on Role of Mesomechanics for Development of S&T Mini-Symposia on Use of Intelligent Material Computational Mechanics Composite Technologies	Xi'an, Beijing, Dalian, Shanghai, China
Jun 5-9, 00	The 10th International Conference on MetalOrganic Vapor Phase Epitaxy (ICMOVPE-X)	Hokkaido, Japan
Jul 2-6 00	**9th US-Japan Conference on Composite Materials**	**Shizuoka, Japan**
Jul 9-14, 00	**22nd International Symposium on Rarefied Gas Dynamics (RGD22)**	**Sydney, Australia**
Jul 11-13, 00	2000 International Microprocesses & Nanotechnology Conference	Tokyo, Japan
Jul 11-14, 00	Fifth Optoelectronics and Communications Conference	Chiba, Japan
Jul 12-14, 00	The International Workshop on Activematrix Liquid-Crystal Displays-TFT Technologies & Related Materials	Tokyo, Japan
Jul 26-28, 00	**Photonic Taiwan 2000**	**Taipei, Taiwan**
Aug 6-11, 00	7th International Symposium on Polymer Electrolytes (ISPE7)	Queensland, Australia
Aug 16-18, 00	**4th International Conference on Fracture and Strength of Solids**	**Pohang, Korea**
Aug 18-20, 00	**2nd Asian-Australasian Conference on Composite Materials (ACCM-2000)**	**Kyongju, Korea**
Aug20-23, 00	**Topical Workshop in Heterostructure Materials (TWHM'00)**	**Japan**

Aug 27-Sep 1, 00	26th International Congress on Occupational Health	Singapore
Sep 10-15, 00	The 11th International Conference on Molecular Beam Epitaxy	Beijing, China
Sep 13-15, 00	The International Conference on the Physics and Application of Spin-Related Phenomena in Semiconductors	Sendai, Japan
Sep 17-22, 00	25th International Conference on the Physics of Semiconductors (ICPS25)	Osaka, Japan
Sep 24-27, 00	The 9th International Conference on Shallow-Level Centers in Semiconductors	Hyogo, Japan
Sep 24-27, 00	International Workshop on Nitride Semiconductors	Nagoya, Japan
Sep 24-28, 00	The 9th International Conference on High Pressure Semiconductor Physics	Hokkaido, Japan
Sep 25-29, 00	The 14th International Conference on High Magnetic Fields in Semiconductor Physics	Shimane, Japan
Sep 27-29, 00	9th International Symposium on Semiconductor Manufacturing (ISSM2000)	Tokyo, Japan
Nov 19-23, 00	**International Conference on Communication Systems (ICCS'00)**	**Singapore**
Nov 20-23, 00	3rd International Hydrology and Water Resources Symposium	Perth, Australia
Nov 28-1 Dec, 00	4th Asia Pacific Conference on Computer Human Interaction (APCHI) 6th S.E. Asian Ergonomics Society Conference (ASEAN Ergonomics)	Singapore
Nov 29-1 Dec, 00	2nd International Conference on Experimental Mechanics	Singapore
May 14-18, 01	**Indium Phosphide and Related Materials, 2001 (IPRM'01)**	**Nara, Japan**
June, 01	**International Light Materials Conference (LiMat 2001)**	**Pusan, Korea**
Jul 7-11, 03	**5th International Congress on Industrial and Applied Mathematics**	**Sydney, Australia**

Upcoming Window-on-Science Visitors

Contact us for more details if you are interested in the following WOS visitors.

Dates	Visitor Name	Affiliation and Country	Topic	Visit Location
5-11 Dec 99	Dr. Masahito Watanabe	NEC Corporation, Japan	Silicon Crystal Growth	AFRL/SNHX (Hanscom AFB) SUNY Stony Brook
10-11 Jan 00	Dr. Timothy Cutmore	Griffith, Australia	2-Dimensional Eye Tracking for Interface Selection and Control	AFRL/HECP (WPAFB)
18-19 Jan 00	Prof. Young-Suk Lee	Chonnam National University, South Korea	Korean Anthopometry Data and the Development of Innerware for Human Sensibility	AFRL/HE (WPAFB)
15 Feb 00	Dr. Koo-Hyoung Lee	LGE Corporate Design Center, South Korea	Human Centered Technology and Human Sensibility. LG Electronic Corporate Design Center	AFRL/HE (WPAFB)
24-28 Jan 00	Dr. Koji Sugioka	The Institute of Physical and Chemical Research (RIKEN) Japan	Laser Applications in Microelectronics and Optoelectronic Manufacturing	Aerospace Corp, LAMOM-V Conference, San Jose, CA
24-28 Jan 00	Dr. Toshimitsu Akane	RIKEN, Japan	Laser Applications in Microelectronics and Optoelectronic Manufacturing	Aerospace Corp, LAMOM-V Conference, San Jose, CA
24-28 Jan 00	Dr. Kotaro Obata	RIKEN, Japan	Laser Applications in Microelectronics and Optoelectronic Manufacturing	Aerospace Corp, LAMOM-V Conference, San Jose, CA
24-28 Jan 00	Dr. Takehito Yoshida	Matsushita Corp Japan	Laser Applications in Microelectronics and Optoelectronic Manufacturing	Aerospace Corp, LAMOM-V Conference, San Jose, CA
24-28 Jan 00	Dr. Ju Yong Feng	Singapore Univ. Singapore	Laser Applications in Microelectronics and Optoelectronic Manufacturing	Aerospace Corp, LAMOM-V Conference, San Jose, CA
10-11 Feb (TBD)	Prof. Soo-Ik Oh	Seoul National Univ., Korea	Development of ALPID Code	AFRL/MLLM
9-10 Mar (TBD)	Prof. Soon-Hyun Hong	Korea Institute of Advanced S&T (KAIST)	Functional Graded Material Develop	AFRL/MLLM
9-10 Mar (TBD)	Prof. Sung-Hak Lee	Pohang Univ. of S&T, Korea	Deform Behavior of Intermetallics	AFRL/MLLM

9-10 Mar (TBD)	Prof. Jun-Ichi Koike	Tohoku University, Japan	Develop of 62222 Titanium Alloy	AFRL/MLLM
24-28 Apr 00	Dr. Yuriko Aoki	Hiroshima Univ, Japan	Multiscale Modeling of Organic Materials	WOS in conjunction with Spring 2000 MRS meeting, San Francisco, CA
24-28 Apr 00	Dr. Koji Tashiro	Osaka Univ	Multiscale Modeling of Organic Materials	WOS in conjunction with Spring 2000 MRS meeting, San Francisco, CA
15-19 May (TBD)	Prof. Hiroshi Hatta	Institute of Space and Astro Sciences (ISAS), Japan	High Temp Oxidation Behavior of SiC-coated carbon	AFRL/MLLM AFRL/VSDV
15-19 May (TBD)	Prof. Toru Fujii	Doshisha Univ., Japan	Develop of Environmentally Safe Composite Materials	AFRL/MLLM AFRL/VSDV
15-19 May (TBD)	Prof. Rhys Jones	Monash University, Australia	Damage Repair of Composite	AFRL/MLLM AFRL/VSDV
15-19 May (TBD)	Prof. O-Il Byon	Nihon University, Japan	Composite Durability	AFRL/MLLM AFRL/VSDV
22-24 May	Prof. Kigook Song	Kyung Hee Univ., Korea	Development of Liquid Crystal Polymers	AFRL/MLBP
10-13 Aug	Prof. Wan Soo Huh	Soonsil University, Korea	Develop of Polycrystalline Materials	AFRL/MLBP
20-23 Aug 00	Prof. Greg Walker	Univ. of Tasmania, Australia	Boundary Layer Transition and Unsteady Aspects of Turbonachinery Flows	WOS in conjunction with Conference at Syracuse Univ, NY

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